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atmospheres, with a total resistance to flow in the trunk of 10–12A. "It appears, therefore," concludes EWART, "that to maintain flow, a pumping action of some kind or other must be exercised in the wood, for which the presence of active living cells is essential. . . . . There is no known means by which these cells can directly pump water in a definite direction. . . . . It is suggested that the wood parenchyma cells, by the excretion and reabsorption of dissolved materials, may bring into play surface tension forces within the vessels of sufficient aggregate intensity to maintain a steady upward flow, and to keep the water of the Jamin's chains in the vessel in a mobile condition, ready to flow to wherever suction is exercised."

But STEINBRINCK declares himself (*l. c.*) unable to form any conception of how such an action can be produced, and LARMOR objects[14] on purely mechanical grounds, saying: "If the osmotic gradient, assisted by capillary pull at the leaf orifices, is insufficient to direct a current of transpiration upward, *capillary* alterations inside the vessels, arising from vitally controlled emission and absorption of material from the walls cannot be invoked to assist." He suggests that *osmotic* changes in the vessels, of peristaltic character, might do; but he apparently does not know that osmotic phenomena do not occur in sap vessels. As a physicist, he inquires whether there is a sufficient stock of energy in the stems for the pumping work required; and he renews the eminently plausible suggestion that the work is done where the external energy is received, viz., in the leaves.

It cannot be said that these researches have solved the problem of water movement. But each in its own way has added something to our knowledge. The more hopeful lines seem to be in determining physical factors and studying more closely the dynamics of the question.—C. R. B.

Gymnosporangium galls.—The anatomical changes induced by *Gymnosporangium clavariaeforme* and *G. juniperinum* on the twigs and leaves of their host, *Juniperus communis*, have been investigated by LAMARLIÈRE[15] with the following main results. The mycelium of *G. clavariaeforme* inhabits the cortex and phloem regions, but does not penetrate into the wood. The cells of the cortex are multiplied and enlarged so that all lacunae are obliterated, resulting in a general hypertrophy of this region. The formation of collenchymatous tissue is almost entirely suppressed. In the phloem region the medullary rays undergo the most marked transformation. Not only do the rays themselves become more numerous, but the cells composing them are also greatly increased in number, so that this tissue is likely to make up about one-half the volume of the bast region. The sieve tubes, parenchyma, and bast fibers retain their normal succession, but owing to the great increase in parenchyma from the rays and from the increased volume of the bast parenchyma, the course of the sieve tubes and bast fibers becomes distorted and irregular. The cambium ring also is broken and irregular from the fact that uniform differentiation into phloem and xylem no longer occurs. In the wood the medullary rays undergo transformation as in the phloem, becoming irregular masses of parenchymatous storage tissue. The wood is also considerably enlarged.

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[14] LARMOR, J., Note on the mechanics of the ascent of sap in trees. Proc. Roy. Soc. B. **76**:460–3. 1905.

[15] LAMARLIÈRE, L. GÉNEAU DE, Sur les mycocécidies des Gymnosporangium. Ann. Sc. Nat. Bot. IX. **2**:313–350. *pls. 8–12.* 1905.

In *G. juniperinum* the changes are similar but less marked, the greatest changes in the medullary rays being near the periphery. The sieve tubes are mostly suppressed and the xylem is somewhat reduced. In the leaves the chief change induced by this fungus is the transformation of the spongy parenchyma into palisade-like tissue. The observations of this writer agree in detail with the more extensive account of WOERNLE, whose excellent paper on the anatomical changes induced by both the European and American species of Gymnosporangium is nowhere cited or referred to in the article.

As a general result of the effects of the fungus on its host, LAMARLIÈRE points out the tendency toward "parenchymatization," i. e., a tendency of the cells to remain in their more undifferentiated form, a phenomenon from which he draws a parallel to tuber formation.—H. HASSELBRING.

Dioecism among Mucorales.—In continuation of his studies of dioecism among the Mucorales, BLAKESLEE[16] has recently investigated the extent to which differentiation of sex occurs in the spores from germ-sporangia obtained from zygospores. The principal results contained in the paper are as follows. The germ-sporangia of the homothallic species *Sporodinia grandis* and *Mucor* I (undescribed) contain but a single kind of spores, which produce mycelia again capable of forming zygospores. With the heterothallic species the case is different. Here spores in the germ-sporangium may be either all (+) or all (−), or (+) and (−) may be mixed. Of the species tested, *Mucor mucedo* produces all (+) or all (−) spores in its germ-sporangia, showing that a segregation of sex takes place at some period previous to the formation of spores. In *Phycomyces nitens*, however, (+) and (−) spores are mixed in the same germ-sporangium, together with others that show a tendency to produce a homothallic strain. The mycelia of the homothallic strain are characterized by the production of irregular contorted growths to which the writer gives the name *pseudophores*. The production of sporangia on these mycelia is very limited. The spores from them show a segregation into (+) and (−), and others reproducing the homothallic strain.

The reading of this paper is made somewhat difficult partly through lack of clearness in style, which is as essential in scientific exposition as is accuracy in investigation, and partly through the loose use of terms introduced by the author himself. The terms heterothallic and homothallic as used in the earlier papers on zygospore-formation apply to the condition of sexual differentiation of the individuals within a species, strain, or form, being equivalent to dioecious and monoecious. While it is possible to speak of a heterothallic species or race, it

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[16] BLAKESLEE, A. F., Zygospore germinations in the Mucorineae. Annales Mycol. 4:1–28. 1906.